Problem 1 It is an axiom that a sum of money today is worth more than the same amount of money tomorrow. How much more depends on prevailing interest rate and the way it is compounded. Suppose

- \(pv\) is the present value (the value of investment today),
- \(r\) is the annual interest rate,
- \(n\) the frequency of compounding: so if we are compounding on a monthly basis, then \(n = 12\), on a quarterly basis \(n = 4\) and so on,
- \(fv\) the value of investment in future.
- \(n\text{Per}\) the number of periods, where one period is \(\frac{1}{n}\) of a year.

Thus, if compounding is monthly and investment lasts 1.5 years, then \(n\text{Per} = 18\) months. In general if \(y\) is the duration of investment in years, then \(n\text{Per} = y \times n\)

Then the value of the investment in future is calculated by

\[fv = pv(1 + \frac{r}{n})^{n\text{Per}} = pv(1 + \frac{r}{n})^{ny}\]

If we are applying continuous compounding then we let \(n \rightarrow \infty\). In that case (remembering from calculus that \((1 + \frac{r}{n})^n \rightarrow e^r\) as \(r \rightarrow \infty\)),

\[fv = pv \times e^{rx}\]

2a If you deposit $10,000 in saving account with interest rate of 5.25% compounded monthly, how much will you have after three years? What if the interest is compounded biweekly? Daily? What if it is compounded continuously? Compare these values and explain how the future value changes as \(n\) increases. Create a chart of the future value against \(n\), with all other parameters fixed.
2b. How much do you need to deposit in a saving account that pays a fixed rate of 4.75% compounded daily to collect $25,000 in four years?

**Problem 2** If in addition there is a payment at the end of each period of $pmt$, then the formula for future value is given by

\[ fv = -pv \left(1 + \frac{r}{n}\right)^{n\text{Per}} - \frac{pmt \times n}{r} \left(\left(1 + \frac{r}{n}\right)^{n\text{Per}} - 1\right). \]

1a. If a car dealer is selling a car for either $36,000 cash, or offers to lease it for 5 years and option of owning it at the end of 5 years by paying $15,000, how much monthly payment should he ask for the lease if the interest rate charged is 6% compounded monthly?

1b. If a house is worth $350,000 and the buyer gets a 30 year mortgage from the bank for $2,000 monthly payment after paying for 20% down payment, what is the underlying interest rate? (Use goal seek feature of Excel to get the interest rate?)

1c. If the bank offers to collect $950 on the first and fifteenth of each month (thus making \( n = 24 \)), on the same mortgage as in previous problem, what is the implied annual interest rate?

**Problem 3** Do problem 29 on page 37 of your text.

**Problem 4** Do problem 11 on page 65 of your text.

**Problem 5** Do problems 42 and 43 on page 102 of your text.

**Problem 6** Do problem 50 on pages 105-106 of your text.